Discourse processing: an interview with Professor Evelyn Ferstl

Processamento do discurso: uma entrevista com Evelyn Ferstl

Evelyn C. Ferstl[1]
Bernardo Kolling Limberger[2]
Augusto Buchweitz[3]

[1] University of Freiburg, Germany.
[2] Universidade Federal de Pelotas, Centro de Letras e Comunicação. Pelotas, RS, Brazil.
[3] Pontifícia Universidade Católica do Rio Grande do Sul, Programa de Pós-Graduação em Letras. Porto Alegre, RS, Brazil.

[1] Albert-Ludwigs-Universität Freiburg, Center for Cognitive Science. Freiburg, Baden-Württemberg, Germany.
https://orcid.org/0000-0001-8335-1276
E-mail: evelyn.ferstl@cognition.uni-freiburg.de

[2] Doctor in Linguistics (PUCRS). Professor at the University of Pelotas, UFPel (Center of Letters and Communication), RS, Brazil.
https://orcid.org/0000-0001-5504-2361
E-mail: limberger.bernardo@gmail.com

[3] Professor of the School of Humanities and researcher at the Brain Center of Rio Grande do Sul (Inscer), PUCRS, Porto Alegre, RS, Brazil.
https://orcid.org/0000-0003-3791-7472
E-mail: augusto.buchweitz@pucrs.br

Evelyn Ferstl holds a Ph.D. and an M.A. in Psychology at the University of Colorado, USA. She is Professor of Cognitive Science and Gender Studies at the University of Freiburg, Germany, and since October 2013 she has been director of the *Center for Cognitive Science*. Professor Ferstl has an extensive research record and publications on topics about discourse processing and the respective functional anatomy. She proposed a model of the neuroanatomy of discourse processing, the Extended Language Network (FERSTL, 2007; FERSTL et al., 2008). Moreover, she studies gender differences, neuropsychology of high-level language processes and language disorders, and the interaction between emotion and cognition in language comprehension (e.g., processing of emotion words, Theory-of-Mind, mood induction and integration of emotional information in texts). Since April 2015 she has been Professor in the Graduate Program of Cognitive Science. In 2016 Bernardo Limberger was as a visiting Ph.D. student at her department in Freiburg. For more information, see <http://portal.uni-freiburg.de/cognition/mitarbeiter/ferstl/publikationen>.

1. **Bernardo K. Limberger and Augusto Buchweitz** – How do neuro-scientific studies contribute to further understanding of discourse comprehension processes and their models, such as a distinction between micro- and macrostructure of text (KINTSCH; VAN DIJK, 1978) or the well-known construction-integration model (KINTSCH, 1988)?

Evelyn Ferstl – Researchers in experimental psychology need to design tasks and language materials that allow us to quantify the comprehension process. For example, one might ask participants to read a textbook chapter about some topic and ask them to take an exam afterwards. The number of correctly answered questions would then be the comprehension score. This score can be used to evaluate the difficulty of a particular text or changes across the life span. However, we do not learn what happens *during* comprehension (on-line), because the test is taken *after* reading (off-line). To assess the on-line processes, we might present the text one word at a time and measure reading times. This method gives information about the difficulty of the words, without telling us much about the source of this difficulty. Neuroscientific methods, in contrast, can dissociate subprocesses of the comprehension process. For instance, the EEG (electro-encephalogram) shows that the brain immediately distinguishes semantic violations, in which the meaning of a word does not fit into the sentence, from syntactic violations, in which the grammar contains an error. These differences are evident not only in the amplitude and polarity of the EEG signals, but also in the distributions of the effects across the scalp. Similarly, functional magnetic resonance imaging (fMRI) helps us to identify brain regions that are particularly active during comprehension, without the need for an experimental task. When looking at results of neuroimaging studies of discourse comprehension, we find that some brain regions play a role that was not considered important for higher level language comprehension

before. Among others, inferencing involves activation of areas in the fronto-medial cortex, and the integration of words into phrases or idea units is reflected in anterior temporal activation. These and other results are not easily mapped on to the classical models you mention in your question. Instead, neuroscientific models of discourse comprehension (e.g., by Mason & Just, 2006) note the similarity between discourse comprehension and social cognition, and include processes such as protagonist monitoring, emotion appreciation or Theory-of-Mind. Future research is needed to bring together these overlapping, but distinct approaches.

——

2. **Bernardo K. Limberger and Augusto Buchweitz** – Does this neuroscientific investigation of discourse processes present more methodological and interpretation challenges than the investigation of word-level processes? What are the main challenges when investigating the neural bases of discourse processes?

Evelyn Ferstl – No, I actually do not think so. On both, the word and the text level, the challenge is to find the right balance between the attempt to localize specific regions on one hand, and apply a more holistic network approach on the other hand. For both types of interpretation, the design of the experiment is crucial. The language materials used need to be carefully selected based on linguistic features. Many earlier neuroimaging studies did not apply the principles of psycholinguistic research – due to methodological constraints – and used, for example, blocked designs, in which the same type of sentence was repeated frequently. Thus, the participants could guess what the experiment was about and possibly apply some strategies they would not use when reading the newspaper or a novel. Recent methodological advances overcome these problems. A number of researchers now use

designs with long, natural stories, rather than short experimental "textoids", and they apply sophisticated statistical analyses to disentangle different subprocesses of comprehension.

━━━

3. **Bernardo K. Limberger and Augusto Buchweitz** – Recently, you published an eye-tracking study about humor processing (FERSTL; ISRAEL; PUTZAR, 2017). What is the main finding of the study?

Evelyn Ferstl – The experiment investigated the comprehension of verbal humour. We presented short jokes to participants, of the type sometimes found in newspapers. While participants read these jokes, intermixed with many similar stories that were not funny, we monitored their eye movements to obtain information about where in the text they would spend more time or jump back to reread previous words. The question of interest was whether readers would take longer reading the punchline of these jokes than the last sentences of similar stories that were not funny. This question directly follows from so-called incongruity theories of verbal humor that postulate that the feeling of mirth results from noticing and resolving an incongruity – processes that are expected to take time and effort. In fact, just opposite to this prediction, we actually found faster reading times for the jokes. The punchlines were as easy to understand as control texts, and there was no evidence for processing difficulties or for increased reading times. This result corresponds very well to our intuition: getting a joke is usually easy and happens suddenly and unexpectedly. At this time, none of the humour theories can explain this empirical result, as far as I know. Another interesting finding, that we didn't predict, was that for men the difference between jokes and other texts was a bit larger than for women. We interpreted this in the context of findings that women are better

language users in general – whereas men can take advantage of the little push the funniness of the jokes gives them. However, this interpretation is post-hoc, and we would need much more research on gender differences in language to be able to come to definite conclusions.

━━━

4. **Bernardo K. Limberger and Augusto Buchweitz** – The distributed anatomy of the Extended Language Network (FERSTL, 2007; FERSTL et al., 2008) suggests that "language comprehension requires more than just understanding words and sentences" (FERSTL et al., 2008, p. 582). The proposal of the ELN has been influential in cognitive neuroscience studies of language comprehension. Ten years later, what has changed and could be understood differently about the ELN and discourse processing?

Evelyn Ferstl – Although I called the ELN "network" we did not pay attention as much to the actual functional and/or anatomical interconnections between regions. The meta-analysis on which the concept was built, merely listed brain regions that were consistently active during comprehension of certain types of language stimuli. In contrast, recent research is concerned more with the description of functional connectivity and its correspondence to anatomical fiber tracts. Another development, mentioned above, is the use of naturally occurring texts and big data methods for analysis. Finally, the earlier studies have increased the appreciation that discourse processing requires the entire brain machinery, and not just the well-documented language regions, Broca's and Wernicke's areas.

━━━

5. **Bernardo K. Limberger and Augusto Buchweitz** – One of the lines of research in your lab is about discourse processes and dialect and

Letrônica | Porto Alegre, v. 11, n. esp. (supl. 1), s210-s214, set. 2018

s212

nondialect speakers. This is an area of interest in southern Brazil, because of our dialects. What can you tell us about the early findings of your research in the field?

Evelyn Ferstl – Dialects are fascinating because they allow us to study oral language independent of reading and writing. We all remember our parents or grandparents telling stories or talking to us – and in most families a regional variety of their native language is spoken. Formal instruction during later schooling changes the way language is used. At the same time, bilingualism becomes an ever more interesting phenomenon because so many people all across the world speak several languages, possibly because of migration, or because global interactions make it necessary to supplement the local language with a more widely used language. When I visited Porto Alegre in 2015 I was fascinated by the fact that in Rio Grande do Sul so many people still speak a version of the Hunsrückisch dialect, even though the immigration from this region in Germany to Brazil started more than 150 years ago.

My own interest in dialects comes from the fact that my own first language is Bavarian, the dialect spoken in Southern Germany around Munich. Much later, when I lived in other countries and other regions of Germany, I realized that speaking Standard German, rather than the dialect of my childhood, almost felt like speaking a foreign language – and it still requires some concentration and effort. So I was excited when in collaboration with the German linguistics department in Freiburg we conducted a well-informed neuroimaging study comparing the Alemannic dialect to Standard German. The idea was to use stories, rather than single words, to study how higher level comprehension – and not merely word recognition – is influenced by the dialect. The PhD student Julia Schmitt translated fairy tales by the brothers Grimm into four different varieties:

English, Alemannic, Bavarian and Standard German (SCHMITT, 2017). Participants listened to these stories while they were scanned using functional magnetic resonance imaging (fMRI). In the recordings, we took particular care that all versions were rather "mild", that is, they were supposed to be understandable even for speakers of Standard German. With the comparison between English and Standard German, we attempted to replicate known findings from bilingualism research. The conditions of interest, however, were the two dialects. None of the participants spoke Bavarian – but this dialect is rather familiar and often heard on, let's say, TV. Half of the participants were selected because they grew up in an Alemannic environment, the dialect spoken in the region around Freiburg. The main differences in activation levels between these two dialects were located in the anterior temporal lobes. The better the comprehension, the more activation was found in this region. This result is perfectly consistent with the idea that the aTL is important for building phrases or idea units from single words could not have been obtained without the use of the connected stories. Interestingly, prefrontal cortex activations were comparable across language varieties, reflecting the fact that participants did not have general comprehension difficulties: Their question answering performance was pretty good even in Alemannic and Bavarian. However, all of our participants speak Standard German, which they might have been using for decoding the unfamiliar dialect. It would be fascinating to conduct similar experiments in Brazil with participants who speak Rio Grande Hunsrückisch (LIMBERGER, 2018; LIMBERGER; BUCHWEITZ, 2014). This population would enable us to include groups with and without formal schooling in German. Similar to studies conducted by Bernardo Limberger, this comparison would help us to further specify the influence of the knowledge of the Standard variety in dialect comprehension.

———

References

FERSTL, E. C. The Functional Neuroanatomy of Text Comprehension: What's the Story so far? In: SCHMALHOFER, F. (Ed.). *Higher Level Language Processes in the Brain:* Inference and Comprehension Processes. Lawrence E. ed. Mahwah, NJ: Psychology Press, 2007. p. 53-102.

FERSTL, E. C. et al. The extended language network: A meta-analysis of neuroimaging studies on text comprehension. *Human Brain Mapping*, v. 29, n. 5, p. 581-593, 2008. https://doi.org/10.1002/hbm.20422

FERSTL, E. C.; ISRAEL, L.; PUTZAR, L. Humor Facilitates Text Comprehension: Evidence from Eye Movements. *Discourse Processes*, v. 54, n. 4, p. 259-284, 2017. https://doi.org/10.1080/0163853X.2015.1131583

KINTSCH, W. The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review,* v. 95, n. 2, p. 163-182, 1988. https://doi.org/10.1037/0033-295X.95.2.163

KINTSCH, W.; VAN DIJK, T. A. Toward a Model of Text Comprehension and Production. *Psychological Review*, v. 81, n. 2, p. 363-394, 1978. https://doi.org/10.1037/0033-295X.85.5.363

LIMBERGER, B. K. *Processamento da leitura e suas bases neurais:* um estudo sobre o hunsriqueano. 2018. 269 p. Dissertation (Ph.D. in Linguistics) – Programa de Pós-graduação em Letras, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, 2018.

LIMBERGER, B. K.; BUCHWEITZ, A. The effects of bilingualism and multilingualism on executive functions. *Fórum Linguístico*, v. 11, n. 3, p. 261-277, 2014. https://doi.org/10.5007/1984-8412.2014v11n3p261

SCHMITT, J. M. *Bilektalität:* Untersuchung zur neuronalen Verarbeitung von Dialekt und Standarddeutsch. 2017. 394 p. Dissertation (Ph.D. in German Studies) – Philologische Fakultät, Albert-Ludwig-Universität Freiburg, Freiburg im Breisgau, 2017.

Letrônica | Porto Alegre, v. 11, n. esp. (supl. 1), s210-s214, set. 2018

s214